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Experiments on the Cultivation of Sugar-cane  
at the Partabgarh Experimental Station,  
1909-1911

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CALCUTTA  
SUPERINTENDENT GOVERNMENT PRINTING, INDIA  
1912



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THE sugar-canies of Upper India differ in a very marked manner from the canes of other countries, and demand very different treatment for their successful culture. The general conclusions holding good for the cultivation of varieties such as the Tanna and Bourbon canes, grown in Java, the West Indies, and the Southern States of America, cannot be always applied to them.

Very little appears to be known about the behaviour of the thin Ukh and Ganna varieties under different conditions of cultivation, beyond the general conclusions arrived at by Leather, in an extensive series of manurial experiments carried out at Cawnpore and elsewhere, that without temperate additions of plant food, particularly nitrogen, to the soil, it is impossible to grow canes successfully, but that attempts to produce abnormal yields of cane by excessive doses of manure, which are profitable in the case of Pounds varieties, do not produce a commensurate increase in the weight of sugar per acre. These conclusions have been confirmed by the authors' experience.

It was therefore a necessary preliminary to a survey of the canes of the United Provinces to study the effect of varying some of the cultural conditions on the character of the crop.

Certain observations made during a preliminary survey of the canes grown at the Partabgarh Farm in 1908 led the authors to believe that some interesting information might be obtained by studying the effect of planting the sets different distances apart. By starting with a small number of sets per acre planted at wide distances apart, and gradually increasing the number of sets by lessening the distance, it might be possible to ascertain with some degree of certainty the optimal number of sets per acre and the optimal distance apart of the sets.

#### EXPERIMENTS ON THE CULTIVATION OF SUGAR-CANE

The cultivators in most parts of these provinces avoid risks due to imperfect germination and other causes by planting a very large number of sets per acre. Dr. Parr, who was kind enough to enquire into the matter, has informed the authors that in the Aligarh, Bulandshahr, and Meerut districts scarcely ever less than 24,000 sets per acre are planted, and frequently as many as 40,000. In other districts, as far as can be ascertained, between 20,000 and 30,000 per acre is usual.

If the germination is moderately good, 30,000 or even 24,000 sets per acre sown in the *desi* manner do not permit each set to tiller and develop to its maximum, and the uneven spacing of the young plants renders difficult any attempts to improve or lessen the expense of the early cultural operations upon which the success of the crop depends. Moreover it seemed very doubtful from the results of the preliminary work if the crowding together of the sets would result in an increased yield of sugar, though possibly a larger weight of cane might be produced.

The experiments recorded in this bulletin were designed to test these points, and although in field work of this kind, with the uncontrollable conditions of season and the variability of the soil to contend with, the scientific accuracy of laboratory work cannot be attained, the results of the three years' experiments are sufficiently consistent for some general conclusions to be drawn.

The experiments were carried out at the Partabgarh Farm, with a variety known as Reora of Benares, widely grown throughout the eastern part of the province, which had been under experiment for some two or three years and had proved one of the most satisfactory of the varieties.

The plots were  $\frac{1}{10}$ th of an acre in extent. The actual dimensions varied from year to year to meet the land at the authors' disposal, but they were always approximately twice as long as broad.

The sets (about 12 inches long) were planted in furrows made by a *desi* plough, at the requisite distance apart. It was found advisable in the actual planting to use two wooden ploughs following each other, in order to secure furrows of the correct depth (about 5 inches).

The following table shows the number of plots grown during the three years of the experiments, the number of sets planted per

acre, and the approximate distance from centre to centre of the sets:—

1908-1909.		1909-1910.		1910-1911.		Distance of sets centre to centre (inches).
Sets per acre.						
1	3,000	...	.....	...	....	15.7
2	4,000	1	4,000	1	4,000	39.6
3	5,000	...	...	...	...	35.4
...	...	2	6,000	2	6,000	32.3
5	7,000	...	.....	...	.....	29.9
6	8,000	3	8,000	3	8,000	28.0
7	9,000	...	....	...	....	26.5
8	10,000	4	10,000	4	10,000	25.6
9	12,000	5	12,000	5	12,000	22.8
10	15,000	6	15,000	...	.....	20.0
11	18,000	7	18,000	6	18,000	18.6
...	....	8	24,000	7	24,000	16.1

The character of the season and the cultural operations are described below.

#### 1908-09.

The year was on the whole characterised by a scanty rainfall. Though monsoon conditions prevailed early, the first important shower was not received until the 30th of June. In July, August, and September, the rainfall was less than the normal, while October and November were practically rainless. As a result of this shortage of rain the sugar-cane crop did not do well.

In the eastern districts generally, when sugar-cane is not grown on fallowed land, it almost invariably follows a pulse crop. In

order not to deviate from the common practice, those plots were chosen for experiment which had been sown with Urd (*Phaseolus radiatus*) in the last rains. As soon as the fields were cleared from the pulse crop, operations were begun for preparing the seed bed for sugar-cane. The soil was ploughed and cross-ploughed three times with Watt's ploughs; five ploughings with the country plough followed, the land being levelled after each ploughing with the flat wooden beam (the *patela*).

Town sweepings at the rate of 200 maunds per acre were applied before planting the seed, the manure was incorporated with the soil by ploughing in with a country plough, and the fields were again levelled.

The sugar-cane intended for seed had been left standing in the field from the previous year's crop. The canes were chopped into pieces of the required size and, before planting, steeped in an emulsion of Neem cake (*Melia Azadirachta Linn*) in order to protect the cuttings as far as possible from white-ants.

The natural moisture had to be supplemented by four waterings during the period of growth. The crop was hoed four times; at first when the plants were tender and less than 1 foot in height the field was levelled with the *patela* each time after the hoeing, but when plants grew up the levelling and breaking of clods had to be done with the feet.

The sugar-cane crop this year did very badly in the district: besides the shortage of rain, which materially reduced the outturn, there were some reports of injuries from white-ants and grasshoppers. Some apprehensions were entertained about its success, and the outturn ultimately proved that they were only too true. The crop of the farm was a happy exception.

#### 1909-10.

The unusual rainfall of April was very propitious for the sugar-cane, as it gave a good start to the growing crop. This year the monsoon rains began much earlier than usual. June had uncommonly heavy rainfall which was fairly equally distributed over the month. The excessive rainfall of July was responsible for water-logging in some villages of the district. The rain ceased early, and there was no fall after 25th September.

AT THE PARTABGARI EXPERIMENTAL STATION, 1909-1911.

As in the previous year, the sugar-cane followed Urd. Before planting the seed cuttings the fields were watered once for preparing the land. Cattle dung was used as manure at the rate of 100 maunds per acre.

Altogether the plots received 8 ploughings (3 with Watt's and 5 with country ploughs); after each ploughing with a country plough the land was levelled with a *patela*.

Four waterings were given during the period of growth, and the fields were hoed eleven times with *kudalis*. All the other operations were similar to those followed in 1908-1909.

The irregular behaviour of the rainfall caused much alarm among the cultivators of the district, and the outturn was on the whole below the average.

There were complaints of white-ants and grass-hoppers appearing in some of the villages.

1910-11.

At the beginning, the season promised to be specially favourable for sugar-cane. Some light showers were received in April and May, and they proved beneficial, while the rainfall in June, July, and August was ample, September was marked by excessive rainfall. The October rains increased the amount of moisture that was already present in the soil. Some showers were also received in November and January.

This year also the sugar-cane was grown after Urd. One preliminary watering was given to facilitate tillage operations, and the plots received four ploughings with the Watt's and ten with the *desi* plough.

The crop was irrigated four times during the growing period, and was hoed ten times with *kudalis*.

All the operations were conducted as in the previous two years.

The crop of the district is reported to have suffered on account of water-logging and other injuries incident on excessive rainfall. Grass-hoppers appeared in some of the fields. The uncommonly wet season retarded the ripening period, and the crop at the farm was found unripe even in January.

The excessive moisture caused by the abundant rainfall, combined, with the high wind that prevailed, in producing a tendency in the plant to grow up too lavishly at the sacrifice of the quality of the juice, and in spite of our efforts to keep the crop erect by tying the plants together, some of the plants fell over. The crop of the district was on the whole fair.

The cane was harvested in the usual way. Samples were taken by cutting every fourth row in the manner described by one of us and Syed Mahomed Hadi Khan Bahadur in Bulletin 13 of the Agricultural Research Institute. As a matter of fact samples of uniform composition were usually obtained in this way, but risk due to errors of sampling was eliminated by proceeding in the above manner until the whole of the cane from each plot was weighed and crushed, generally four or five samples were required for each plot. The juice from each sample was thoroughly mixed, the specific gravity, sucrose, and glucose, determined by the methods described in Bulletin 13.

The details of the experimental results are given in the following tables.

The most interesting results obtained, from the cultivator's point of view, are the total yields of sugar per acre which correspond with the amount of *gur* or raw sugar obtained by boiling down the juice. These results have been graphically represented in the curves shown in fig. 1.

It will be seen that in the plots where the number of sets per acre is small, *e.g.*, from 3,000 to 9,000, and the distance from centre to centre large, the yield of sugar per acre is liable to considerable variation, and the curve for each year's experiments where this number of sets is employed is unsteady; but that in some cases nearly the maximum yield of sugar is obtained with as few as 6,000 to 8,000 sets per acre where the germination and other conditions were exceptional.

When 12,000 sets per acre are reached, the curves for each year's yield become almost stationary, and the total yield of sugar is not increased by increasing the number of sets, though the weight of cane and the composition of the juice, as will be pointed out later on, is liable to vary slightly.

FIG. 1. Yield of Sugar per acre.

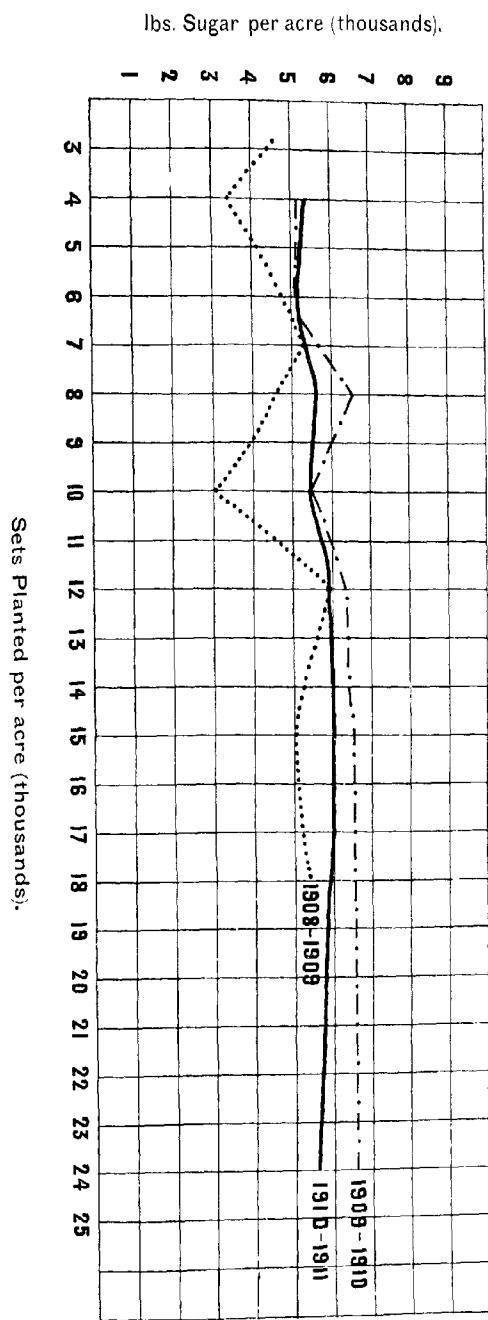
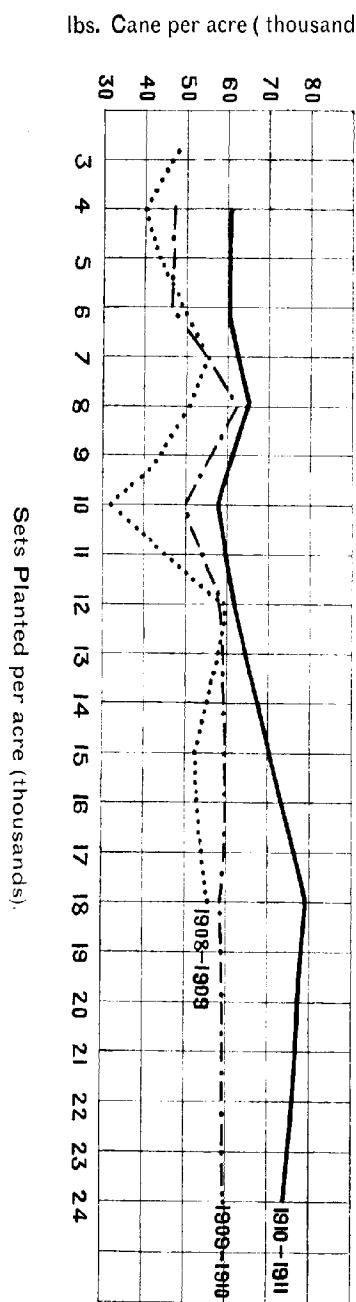






Fig. 2. Yield of Cane per acre.



The interpretation of these results appears to be that although a full crop is possible, under ideal conditions, by planting what is comparatively a very small number of sets per acre (6,000 to 8,000 per acre); under the ordinary conditions of cultivation the risk of not obtaining a full crop, due to imperfect germination and development, is considerable if less than 12,000 to 15,000 sets per acre are planted.

The experiments seem to point to the conclusion that from 12,000 to 15,000 sets per acre, planted at regular intervals apart, with a germination of 60 to 80 per cent., are sufficient to reduce the risk of obtaining a full crop to a minimum and to ensure a maximum yield of sugar under the ordinary conditions of cultivation prevailing in these provinces.

The yields of cane per acre in the three years' experiments have been graphically represented in fig. 2. These results also show that there is risk of not obtaining a full crop where less than 12,000 sets per acre are employed, although it is possible to do so under the best conditions.

These results are on similar lines to those obtained for the total yield of sugar, but it is not a general rule that increased weight of cane always means a correspondingly increased weight of sugar. This is shown in the results for 1911. In the plot where 18,000 and 24,000 sets are planted, 18 and 16 inches from centre to centre, approximately 7 tons per acre more cane was produced than when 12,000 sets were used, but the total yield of sugar is very nearly the same, the only difference being that the proportion of glucose to sucrose is greater, and a weaker and more impure juice is produced. The cane of these plots was not lodged, but so crowded together that the full development of sugar was not possible.

In the whole of the three years' experiments there is no example of any advantage being derived from using the excessive number of sets, planted irregularly, that is common in the *desi* method of cultivation, beyond a kind of insurance against imperfect germination that can be better guarded against by replacing those that have not germinated by fresh ones from a small nursery set aside for the purpose.

There is indeed the additional disadvantage of liability to obtain a weak and impure juice, and, although this disadvantage is not

so apparent when the juice is boiled down into raw sugar and consumed as such, beyond the fact that with the weakest juice the bagasse or dried fibre does not always provide sufficient fuel to complete the process, the production of impure juices becomes a matter of great importance when either the juice or the *gur* is to be used for refining purposes.

Planting the cane in lines at regular intervals has also the additional advantage of enabling the cultural operations to be more easily carried out.

The cane was crushed in the three roller iron bullock mills supplied by the Nahan State Foundry. The results of percentage of juice extracted during the three years under experiment are given in the following table:—

Plot.	1908-1909.	1909-1910.	1910-1911.
	Per cent. juice extracted.	Per cent. juice extracted.	Per cent. juice extracted.
1	59.0	61.5	62.0
2	55.7	60.7	63.1
3	57.3	61.9	62.3
4	59.8	61.8	62.5
5	60.1	61.9	63.2
6	60.6	63.8	64.4
7	58.2	64.0	64.7
8	60.8	64.7	.....
9	61.0	.....	.....
10	61.2	.....	.....

These figures, which are the result of over 130 separate estimations, give a good idea of what can be expected of these mills under normal conditions. At Partabgarh it was found that in a working day of 8 hours 6 of these mills could crush 2 $\frac{3}{4}$  tons of cane, which

AT THE PARTABGARH EXPERIMENTAL STATION, 1909-1911.

works out to 1 mill crushing  $12\frac{1}{2}$  maunds in 8 hours, or a little over  $1\frac{1}{2}$  maunds per hour.

In the season 1908-1909 and 1910-1911 the purest juices and the lowest glucose ratios were obtained with 12,000 sets per acre. In 1909-1910 the juices were of high purity throughout the series, and the glucose ratios exceptionally small. In this year there was a general tendency for the glucose to increase as the number of sets increased. A very small number of sets per acre and a very large number of sets per acre do not seem conducive to either the purest juice or the lowest glucose ratio in average years. In the first case with a small number of sets a possible explanation is that there is a tendency to develop side shoots and in the second case with the large number of sets the ripening may be retarded.

Exceptional yields of cane, as in the case of the two plots in 1910-1911 with 18,000 and 24,000 sets respectively, give a very inferior juice, with both a low purity co-efficient—73 as compared with 84 in the 12,000 plot—and an exceedingly high glucose ratio—19 as compared with  $7\frac{1}{2}$  in the 12,000 plot.

The work at Partabgarh is being continued by comparative trials of the more important of the varieties grown in the eastern district of the province, under the conditions that have been found in the experiments recorded here to give the best yields of sugar per acre.

## 10 EXPERIMENTS ON THE CULTIVATION OF SUGAR-CANE

*Partabgarh Experiments, 1908-1909.*

Plot No.	Stools No. planted per acre.	Sample No.	Weight of cane. lbs.	Weight of juice. lbs.	Per cent. sucrose in juice.	Per cent. glucose in juice.
I . . .		1	948.25	563.25	15.48	0.94
Do. . .		2	1,083.25	671.25	15.75	0.89
Do. . .		3	1,067.75	625.00	15.13	1.08
Do. . .		4	1,540.75	878.25	15.35	1.02
TOTAL AND AVERAGE .	3,000		4,640.00	2,737.75	15.42	0.98
II . . .		1	825.50	474.50	14.34	1.25
Do. . .		2	916.00	417.75	14.54	1.31
Do. . .		3	697.00	400.50	14.39	1.38
Do. . .		4	809.25	490.50	14.03	1.40
Do. . .		5	768.00	456.25	14.22	1.35
TOTAL AND AVERAGE .	4,000		4,015.75	2,239.50	14.29	1.33
III . . .		1	971.25	569.00	14.54	1.83
Do. . .		2	844.00	490.50	14.61	1.83
Do. . .		3	727.00	409.00	15.58	1.48
Do. . .		4	604.50	343.25	15.18	1.73
Do. . .		5	1,212.00	689.50	15.73	1.51
TOTAL AND AVERAGE .	5,000		4,358.75	2,501.25	15.13	1.66

Size of plot 1/10th of an acre.

Weight of sucrose. lbs.	Weight of glucose. lbs.	Total sugar. lbs.	Per cent. extraction.	Purity co- efficient.	Glucose ratio.
87.2	5.3	92.5	59.4	82.8	6.07
105.7	6.9	111.7	62.0	84.2	5.65
94.6	6.7	101.3	58.5	83.5	7.13
134.8	8.9	143.7	57.0	83.8	6.64
422.3	26.9	449.2	59.0	83.5	6.35
68.0	5.9	73.9	57.4	79.6	8.71
60.7	5.5	66.2	45.6	80.7	9.00
57.6	5.5	63.1	57.4	83.1	9.59
68.8	6.8	75.6	60.6	82.5	9.97
64.9	6.1	71.0	59.4	82.2	9.49
320.0	29.8	349.8	55.7	81.6	9.30
82.7	10.4	93.1	58.6	81.6	12.58
71.7	9.0	80.7	58.1	82.0	12.52
63.7	6.0	69.7	56.2	83.7	9.49
52.1	5.9	58.0	56.7	81.6	11.39
108.4	10.4	118.8	56.8	83.2	9.59
378.6	41.7	420.3	57.3	82.4	10.97

*Partabgarh Experiments, 1908-1909.*

Plot No.	Stools No. planted per acre.	Sample No.	Weight of cane, lbs.	Weight of juice, lbs.	Per cent. sucrose in juice.	Per cent. glucose in juice.
V . .		1	872.25	527.75	15.49	0.93
		2	804.75	488.00	14.85	1.03
		3	737.00	441.50	15.35	0.97
		4	839.25	510.25	15.03	1.02
		5	765.00	453.00	15.08	1.05
		6	730.75	432.50	15.46	0.98
		7	765.00	449.00	15.26	1.00
TOTAL AND AVERAGE .		7,000	5,514.00	3,302.00	15.21	0.99
VI . .		1	791.50	436.00	14.78	0.99
		2	590.50	359.00	14.79	1.09
		3	713.75	429.00	15.22	1.00
		4	695.25	414.75	14.72	1.08
		5	625.00	372.00	14.59	1.12
		6	710.50	427.75	14.50	1.19
		7	954.75	506.00	14.40	1.25
TOTAL AND AVERAGE .		8,000	5,081.25	3,054.50	14.71	1.10

## Size of plot 1/10th of an acre.

Weight of sucrose. lbs.	Weight of glucose. lbs.	Total sugar. lbs.	Per cent. extraction.	Purity co- efficient.	Glucose ratio.
81.7	4.9	86.6	60.5	83.2	6.06
72.5	5.0	77.5	60.6	82.8	6.93
67.8	4.3	72.1	59.9	84.8	6.31
76.7	5.2	81.9	60.8	85.8	6.78
68.3	4.7	73.0	59.2	83.6	6.96
66.8	4.2	71.0	59.1	85.4	6.33
68.5	4.5	73.0	58.6	84.6	6.55
502.3	32.8	535.1	59.8	84.3	6.51
71.8	4.8	76.6	61.4	82.1	6.69
53.1	3.9	57.0	60.7	82.0	7.37
65.3	4.3	69.6	59.9	84.0	6.57
61.0	4.5	65.5	59.8	82.7	7.33
54.3	4.1	58.4	59.5	83.3	7.67
62.4	5.1	67.5	60.2	82.4	8.15
81.5	7.1	88.6	59.2	81.3	8.68
449.4	33.8	483.2	60.1	82.5	7.47

*Partabgarh Experiments, 1908-1909.*

Plot No.	Stools No. planted per acre.	Sample No.	Weight of cane. lbs.	Weight of juice. lbs.	Per cent. sucrose in juice.	Per cent. glucose in juice.
VII . .		1	578.00	338.25	14.07	1.51
Do. . .		2	605.00	363.50	13.99	1.61
Do. . .		3	536.75	330.25	13.94	1.45
Do. . .		4	556.00	341.75	14.56	1.34
Do. . .		5	451.75	276.75	13.71	1.54
Do. . .		6	576.25	353.25	14.19	1.39
Do. . .		7	1,066.75	645.50	13.95	1.46
TOTAL AND AVERAGE .	9,000		4,370.50	2,649.25	14.04	1.46
VIII . .		1	575.00	334.50	15.93	1.06
Do. . .		2	610.00	346.25	16.02	1.11
Do. . .		3	570.75	327.50	16.37	1.01
Do. . .		4	482.50	288.00	16.02	1.02
Do. . .		5	502.50	297.25	16.85	0.84
Do. . .		6	542.00	318.50	16.73	0.90
TOTAL AND AVERAGE .	10,000		3,282.75	1,912.00	16.31	0.98

Size of plot 1/10th of an acre.

Weight of sucrose, lbs.	Weight of glucose, lbs.	Total sugar, lbs.	Per cent. extraction.	Purity coefficient.	Glucose ratio.
47.6	5.1	52.7	58.5	79.5	10.73
50.8	5.8	56.6	60.0	79.4	11.50
48.0	4.8	50.8	61.5	79.2	10.40
49.7	4.6	54.3	61.4	80.8	9.20
37.9	4.2	42.1	61.2	77.4	11.23
50.1	4.9	55.0	61.3	79.2	9.79
90.0	9.4	99.4	60.5	79.2	10.46
372.1	38.8	410.9	60.6	79.2	10.39
53.3	3.5	56.8	58.1	81.6	6.65
55.5	3.8	59.3	56.7	81.3	6.92
53.6	3.3	56.9	57.3	81.8	6.16
46.1	2.9	49.0	59.6	82.1	6.36
50.1	2.5	52.6	59.1	84.2	5.00
53.3	2.8	56.1	58.7	83.6	5.37
311.9	18.8	330.7	58.2	82.4	6.00

*Partabgarh Experiments, 1908-1909.*

Plot No.	Stools No. planted per acre.	Sample No.	Weight of cane. lbs.	Weight of juice. lbs.	Per cent. sucrose in juice.	Per cent. glucose in juice.
IX . .		1	1,063.25	657.50	15.43	1.01
Do. . .		2	980.50	597.50	15.71	0.89
Do. . .		3	961.25	573.75	15.58	0.91
Do. . .		4	990.75	586.50	15.65	0.90
Do. . .		5	959.75	594.25	15.38	0.93
Do. . .		6	934.75	576.50	15.66	0.88
TOTAL AND AVERAGE . .	12,000		5,890.25	3,580.00	15.56	0.91
X . .		1	1,003.50	618.75	14.56	1.09
Do. . .		2	1,013.00	619.50	14.70	1.03
Do. . .		3	1,153.25	693.00	14.79	1.13
Do. . .		4	995.50	615.25	14.86	1.02
Do. . .		5	1,074.50	654.25	15.10	0.99
TOTAL AND AVERAGE . .	15,000		5,239.75	3,260.75	14.80	1.05
XI . .		1	946.00	585.75	14.87	1.07
Do. . .		2	938.00	569.25	14.90	1.14
Do. . .		3	883.25	533.25	14.55	1.25
Do. . .		4	906.25	552.75	14.90	1.10
Do. . .		5	601.25	370.50	14.45	1.22
Do. . .		6	638.75	394.25	14.52	1.17
Do. . .		7	610.75	378.25	14.60	1.16
TOTAL AND AVERAGE . .	18,000		5,524.25	3,384.00	14.70	1.15

## Size of plot 1/10th of an acre.

Weight of sucrose, lbs.	Weight of glucose, lbs.	Total sugar, lbs.	Per cent. extraction.	Purity coefficient.	Glucose ratio.
101.4	6.6	108.0	61.8	86.1	6.54
93.9	5.3	99.2	60.9	84.9	5.66
89.4	5.2	94.6	59.6	84.6	5.84
91.8	5.3	97.1	59.1	84.1	5.75
91.4	5.4	96.8	61.9	84.5	6.04
90.3	5.1	95.4	61.6	84.1	5.61
558.2	32.9	591.1	60.8	84.7	5.84
90.1	6.7	96.8	61.6	81.2	7.4
91.0	6.4	97.4	61.1	82.1	7.0
102.5	7.8	110.3	60.1	82.0	7.6
91.4	6.3	97.7	61.8	82.4	6.8
98.8	6.5	105.3	60.9	82.9	6.5
473.8	33.7	507.5	61.0	82.3	7.0
87.1	6.2	93.3	61.9	82.6	7.1
84.8	6.5	91.3	60.6	82.3	7.6
77.6	6.6	84.2	60.3	82.6	6.8
82.3	6.1	88.4	61.0	82.3	7.3
53.5	4.5	58.0	61.6	81.6	6.7
57.2	4.6	61.8	61.7	81.0	8.0
55.2	4.4	59.6	61.9	82.9	7.9
497.7	38.9	536.6	61.2	82.2	7.8

*Partabgarh Experiments, 1999-1910.*

Plot No.	Stools No. planted per acre.	Sample No.	Weight of cane. lbs.	Weight of juice. lbs.	Per cent. sucrose in juice.	Per cent. glucose in juice.
1 . .		1	1,146.0	696.5	17.54	0.24
Do. . .		2	1,086.0	681.5	17.57	0.23
Do. . .		3	954.5	591.5	17.85	0.16
Do. . .		4	1,519.0	922.5	17.98	0.21
TOTAL AND AVERAGE .	4,000		4,705.5	2,892.0	17.75	0.21
II . .		1	838.0	496.0	17.38	0.22
Do. . .		2	907.0	546.0	18.10	0.21
Do. . .		3	913.5	562.5	17.60	0.21
Do. . .		4	814.5	502.5	17.67	0.21
Do. . .		5	1,215.0	738.0	17.57	0.23
TOTAL AND AVERAGE .	6,000		4,688.0	2,845.0	17.66	0.21
III . .		1	1,243.0	739.5	15.92	0.52
Do. . .		2	1,313.0	834.0	15.94	0.55
Do. . .		3	1,288.0	813.0	16.26	0.50
Do. . .		4	1,365.0	837.0	16.78	0.43
Do. . .		5	1,071.0	665.0	16.36	0.47
TOTAL AND AVERAGE .	8,000		6,280.0	3,888.5	16.24	0.49

## Size of plot 1/10th of an acre.

Weight of sucrose, lbs.	Weight of glucose, lbs.	Total sugar, lbs.	Per cent. extraction.	Purity coefficient.	Glucose ratio.
122.2	1.7	123.9	60.8	89.0	1.36
119.8	1.6	121.4	62.8	88.7	1.30
105.6	0.9	106.5	62.0	88.3	0.89
165.9	1.9	167.8	60.7	89.0	1.16
513.5	6.1	519.6	61.5	88.7	1.18
86.2	1.1	87.3	59.2	88.2	1.26
98.8	1.1	99.9	60.2	88.2	1.16
99.0	1.2	100.2	61.4	88.0	1.19
88.8	1.0	89.8	61.7	88.3	1.18
129.7	1.7	131.4	60.7	87.8	1.30
502.5	6.1	508.6	60.7	88.1	1.18
117.7	3.8	121.5	59.5	85.1	3.26
132.9	4.6	137.5	63.5	85.7	3.45
132.2	4.0	136.2	63.1	86.0	3.07
140.4	3.6	144.0	61.3	87.8	2.56
108.8	3.1	111.9	62.1	86.5	2.87
632.0	19.1	651.1	61.9	86.2	3.01

*Partabgarh Experiments, 1909-1910.*

Plot No.	Stools No. planted per acre.	Sample No.	Weight of cane. lbs.	Weight of juice. lbs.	Per cent. sucrose in juice.	Per cent. glucose in juice.
IV . .		1	923.0	550.0	17.54	0.20
Do. . .		2	1,063.5	668.0	17.34	0.21
Do. . .		3	1,095.0	690.0	17.60	0.20
Do. . .		4	1,056.0	660.5	17.84	0.18
Do. . .		5	852.0	510.5	17.56	0.20
TOTAL AND AVERAGE .	10,000		4,989.5	3,085.0	17.57	0.19
V . .		1	990.5	602.0	16.17	0.56
Do. . .		2	894.5	571.0	16.32	0.57
Do. . .		3	1,275.0	824.0	16.58	0.52
Do. . .		4	1,265.0	789.0	16.73	0.48
Do. . .		5	1,472.0	862.0	17.16	0.40
TOTAL AND AVERAGE .	12,000		5,897.0	3,648.0	16.64	0.50
V1 . .		1	911.0	582.5	16.41	0.59
Do. . .		2	985.0	627.5	16.65	0.49
Do. . .		3	1,141.0	735.0	16.52	0.49
Do. . .		4	1,184.0	751.0	16.50	0.43
Do. . .		5	895.0	565.5	16.52	0.62
Do. . .		6	909.0	581.0	16.60	0.57
TOTAL AND AVERAGE .	15,000		6,025.0	3,842.5	16.53	0.53

*Size of plot 1/10th of an acre.*

Weight of sucrose. lbs.	Weight of glucose. lbs.	Total sugar. lbs.	Per cent. extraction.	Purity co- efficient.	Glucose ratio.
96.5	1.1	97.6	59.6	88.5	1.14
115.8	1.4	117.2	62.9	88.4	1.21
121.4	1.3	122.7	63.0	88.4	1.13
117.8	1.2	119.0	62.6	89.2	1.00
90.7	1.0	91.7	60.6	87.3	1.13
542.2	6.0	548.2	61.8	88.3	1.08
97.3	3.4	100.7	60.8	86.9	3.46
93.2	3.3	96.5	63.9	86.3	3.49
136.6	4.3	140.9	64.6	87.6	3.13
132.0	3.8	135.8	62.4	86.6	2.86
147.9	3.6	151.5	58.6	87.5	2.32
607.0	18.4	625.4	61.9	86.9	3.00
95.6	3.4	99.0	63.9	86.8	3.59
104.5	3.1	107.6	63.7	87.2	2.94
121.4	3.6	125.0	64.4	86.4	2.96
123.9	3.6	127.5	63.4	86.4	2.90
93.4	3.5	96.9	63.2	86.0	3.75
96.4	3.3	99.7	63.9	86.4	3.43
635.2	20.5	655.7	63.8	86.5	3.20

*Partabgarh Experiments, 1909-1910.*

Plot No.	Stools No. planted per acre.	Sample No.	Weight of cane. lbs.	Weight of juice. lbs.	Per cent. sucrose in juice.	Per cent. glucose in juice.
VII . .		1	835·0	524·5	16·80	0·44
Do. . .		2	848·0	545·0	17·29	0·43
Do. . .		3	1,017·0	652·0	17·16	0·43
Do. . .		4	817·0	524·5	17·12	0·46
Do. . .		5	782·0	493·5	17·05	0·43
Do. . .		6	786·0	508·0	17·23	0·41
Do. . .		7	772·0	499·5	17·17	0·37
TOTAL AND AVERAGE .	18,000		5,857·0	3,747·0	17·11	0·42
VIII . .		1	709·0	446·0	16·36	0·71
Do. . .		2	960·0	660·5	15·86	0·69
Do. . .		3	740·5	459·0	16·47	0·67
Do. . .		4	729·0	472·0	16·17	0·66
Do. . .		5	727·0	477·5	16·50	0·62
Do. . .		6	732·0	476·0	16·45	0·56
Do. . .		7	664·0	427·0	16·35	0·71
Do. . .		8	742·0	471·0	16·24	0·65
TOTAL AND AVERAGE .	24,000		6,003·5	3,889·0	16·27	0·65

Size of plot 1/10th of an acre.

Weight of sucrose. lbs.	Weight of glucose. lbs.	Total sugar. lbs.	Per cent. extraction.	Purity co- efficient.	Glucose ratio.
88.1	2.3	90.4	62.8	86.1	2.61
94.2	2.3	96.5	64.3	87.7	2.48
111.0	2.8	114.7	64.1	87.5	2.50
89.8	2.4	92.2	64.2	88.2	2.68
84.1	2.1	86.2	63.1	87.9	2.52
87.5	2.0	89.5	64.6	87.8	2.37
85.7	1.8	87.5	64.7	88.0	2.15
641.3	15.7	657.0	64.0	87.6	2.45
73.0	3.2	76.2	62.8	85.6	4.33
104.8	4.6	109.4	68.8	84.8	4.35
75.6	3.0	78.6	62.0	85.3	4.06
76.3	3.1	79.4	64.8	85.1	4.08
78.8	3.0	81.8	65.7	85.9	3.75
78.3	2.6	80.9	65.1	86.1	3.40
69.8	3.0	72.8	64.3	86.5	4.34
76.5	3.1	79.6	63.5	85.9	4.00
633.1	25.6	658.7	64.7	85.6	4.00

*Partabgarh Experiments, 1910-1911.*

Plot No.	Stools No. planted per acre.	Sample No.	Weight of cane. lbs.	Weight of juice. lbs.	Per cent. sucrose in juice.	Per cent. glucose in juice.
I . .		1	1,876.5	1,179.0	12.58	1.08
Do. . .		2	1,945.0	1,237.0	12.77	1.37
Do. . .		3	2,287.0	1,376.0	13.04	1.33
TOTAL AND AVERAGE .	4,000		6,108.5	3,792.0	12.80	1.26
II . .		1	1,252.0	804.0	11.33	1.68
Do. . .		2	1,642.5	1,045.0	11.07	1.75
Do. . .		3	1,546.0	955.0	11.97	1.69
Do. . .		4	1,601.0	1,011.5	11.95	1.56
TOTAL AND AVERAGE .	6,000		6,041.5	3,815.5	11.57	1.66
III . .		1	1,570.5	977.5	11.86	1.65
Do. . .		2	2,027.5	1,242.0	11.90	1.65
Do. . .		3	1,508.0	956.5	11.80	1.56
Do. . .		4	1,391.0	874.5	11.39	1.66
TOTAL AND AVERAGE .	8,000		6,497.0	4,050.5	11.75	1.62

## Size of plot 1/10th of an acre.

Weight of sucrose, lbs.	Weight of glucose, lbs.	Total sugar, lbs.	Per cent. extraction.	Purity coefficient.	Glucose ratio.
148.3	12.7	161.0	62.8	80.1	8.58
157.9	16.9	174.8	63.6	80.3	10.72
179.4	18.3	197.7	60.1	80.4	10.19
485.6	47.9	533.5	62.0	80.3	9.84
91.1	13.5	104.6	64.2	77.1	14.82
115.6	18.3	133.9	63.6	74.8	15.80
114.3	16.1	130.4	61.7	79.8	14.11
120.8	15.7	136.5	63.1	77.6	13.95
441.8	63.6	505.4	63.1	77.3	14.34
115.9	16.1	132.0	62.2	79.0	13.91
147.8	20.5	168.3	61.2	77.7	13.86
112.8	14.9	127.7	63.4	76.6	13.22
99.6	14.5	114.1	62.8	76.4	14.57
476.1	66.0	542.1	62.3	77.4	13.78

*Partabgarh Experiments, 1910-1911.*

Plot No.	Stools No. planted per acre.	Sample No.	Weight of cane. lbs.	Weight of juice. lbs.	Per cent. sucrose in juice.	Per cent. glucose in juice.
IV . . .		1	1,133.5	685.0	13.72	1.27
Do. . . .		2	1,034.0	636.5	13.88	1.25
Do. . . .		3	1,260.0	810.5	13.91	1.15
Do. . . .		4	1,159.5	737.0	14.18	1.13
Do. . . .		5	1,243.0	777.5	14.14	1.17
TOTAL AND AVERAGE .	10,000		5,830.0	3,646.5	13.96	1.18
V . . .		1	1,308.0	827.5	14.25	1.06
Do. . . .		2	1,374.5	875.5	13.64	1.15
Do. . . .		3	1,145.0	726.0	14.34	1.09
Do. . . .		4	1,145.0	725.0	14.08	1.10
Do. . . .		5	1,091.5	680.0	15.37	0.99
TOTAL AND AVERAGE .	12,000		6,064.0	3,834.0	14.29	1.07
VI . . .		1	1,215.0	782.0	10.14	1.93
Do. . . .		2	1,277.5	817.0	10.08	2.01
Do. . . .		3	1,609.0	1,030.0	10.07	1.97
Do. . . .		4	1,733.0	1,133.0	9.75	2.01
Do. . . .		5	1,904.0	1,224.5	10.01	1.89
TOTAL AND AVERAGE .	18,000		7,738.5	4,986.5	10.00	1.95

*Size of plot 1/10th of an acre.*

Weight of sucrose, lbs.	Weight of glucose, lbs.	Total sugar, lbs.	Per cent. extraction.	Purity coefficient.	Glucose ratio.
94.0	8.7	102.7	60.4	82.6	9.25
88.3	7.9	96.2	61.5	83.6	9.00
112.7	9.3	122.0	64.3	82.8	8.26
104.5	8.3	112.8	63.5	83.4	7.96
109.9	9.1	119.0	62.5	83.1	8.27
509.4	43.3	552.7	62.5	83.1	8.45
117.9	8.7	126.6	63.2	83.8	7.43
119.4	10.0	129.4	63.6	82.1	8.43
104.0	7.9	111.9	63.4	84.3	7.60
102.1	7.9	110.0	63.3	83.8	7.81
104.5	6.7	111.2	62.3	88.8	6.44
547.9	41.2	589.1	63.2	84.6	7.48
79.3	15.1	94.4	64.3	71.9	19.03
82.3	16.4	98.7	63.9	73.0	19.94
103.7	20.2	123.9	64.0	74.6	19.56
110.4	22.8	133.2	65.3	72.2	20.61
122.6	23.1	145.7	64.3	74.7	18.88
498.3	97.6	595.9	64.4	73.2	19.50

*Partabgarh Experiments, 1910-1911.*

Plot No.	Stools No. planted per acre.	Sample No.	Weight of cane. lbs.	Weight of juice. lbs.	Per cent. sucrose in juice.	Per cent. glucose in juice.
VII		1	1,534.0	972.5	10.18	1.96
Do.		2	1,193.0	792.5	9.99	1.85
Do.		3	1,304.0	848.0	10.08	1.91
Do.		4	1,579.0	1,032.5	9.63	1.97
Do.		5	1,608.5	1,025.0	10.19	1.91
TOTAL AND AVERAGE		24,000	7,218.5	4,670.5	10.00	1.92

*Size of plot 1/10th of an acre.*

Weight of sucrose. lbs.	Weight of glucose. lbs.	Total sugar. lbs.	Per cent. extraction.	Purity co- efficient.	Glucose ratio.
99.0	19.0	118.0	63.3	73.2	19.25
79.2	14.6	93.8	66.4	74.0	18.31
85.5	16.2	101.7	65.0	73.5	18.94
99.4	20.3	119.7	65.3	73.5	20.45
104.4	19.6	124.0	63.7	73.3	18.74
467.5	89.7	557.2	64.7	73.5	19.20

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